Appendix I Hydrology

Table I-1. Temperature Monitoring Locations on BLM Lands and Years Monitored

Site ID	Site Location Description	Highest 7 day temperature for period of record	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
HAWK	Hawk Creek above Sugarpine Creek	74.7					X	X	X	X	X	X
SUGA	Sugarpine Creek above Hawk Creek	72.2					X	X	X	X	X	X
WELK	West Branch Elk Creek above Morine Creek Road	66.6						X				
WEKL	West Branch Elk Creek lower section in T33S, R1E, Sec. 7	70.7										X
ELKW	West Branch Elk Creek below Morine Creek Bridge	70.4					X					
WEKM	West Branch Elk Creek below BLM section line T33S, R1W, Sec. 1	69.4										X
MORI	Morine Creek above Hungry Creek	64.1		X	X	X	X	X	X	X	X	X
HUNG	Hungry Creek @ confluence of Morine Creek	63.2		X	X	X	X	X	X	X	X	X
ELKH	Elkhorn Creek above Hawk Creek	70.6										X
HAKT	Hawk Creek above confluence with Timber Creek in Section 3	66.3										X
MIDE	Middle Creek at Elk Creek	74.7										X
MIDM	Middle Creek at south BLM boundary in Section 29	69.4										X
SUGP	Sugarpine Creek at northern property line Section 11	71.5										X
TMBB	Timber Creek Below the confluence with site BUCK	63										X
TIMT	Timber Creek at West BLM boundary of Section 8	63.6										X
TIMM	Timber Creek at west BLM boundary of Section 9	62.9										X
TIMH	Timber Creek at Hawk Creek	73.9										X

Table I-2. Hydrologic Recovery

Subwatershed	Pre-fire	Post-fire estimates
Sugarpine	82.7	72.7
Sugarpine TSZ	81.6	71.6
West Branch Elk	77.7	67.7
West Branch Elk TSZ	81.8	71.8
Flat Creek	76.1	66.1
Flat Creek TSZ	83.6	73.6
Button	73.5	73.5
Bitter Lick	84.1	84.1

Assume 10% change from mid- and late seral stage to early seral stage based on numbers calculated from BLM-administered lands.

Table I-3. Amount Burned in Transient Snow Zones

	Burn Severity											
	High		Moderate		Low		Very Low/ Unburned		Unburned		Total	
TSZ	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
Flat Creek	7%	163	33%	727	31%	676	25%	558	4%	83	21%	2207
West Branch Elk	0.5%	11	5%	100	9%	182	11%	221	73%	1,420	18%	1933
Sugarpine Creek	1.5%	94	8%	529	6%	399	14%	889	70%	4,550	61%	6460
									Total Transient Snow Zone Acres			**10,600**

Table I-4. Miles of Road Work by Subwatershed

Subwatershed	Full Decommission	Partial Decommission	Improve	Improve/ Gate	Renovate	Renovate/ Gate
Elk Creek/Flat Creek						
Alt. B, C, D, G	9.8	1.4	11.2	1.0	16.6	8.1
Alt. E	10.5	2.0	11.2	1.0	20.0	8.3
Alt. F	7.3	1.3	10.9	1.0	16.2	8.1
West Branch Elk Creek						
Alt. B, C, D, G	15.7	0.2	2.4	0.0	20.1	0.7
Alt. E	18.5	2.4	5.4	1.4	36.5	2.6
Alt. F	4.1	0.2	2.0	0.0	13.3	0.7
Sugarpine Creek						
Alt. B, C, D	7.1	0.9	9.9	0.0	6.6	0.5
Alt. E	7.5	0.9	9.9	0.0	9.9	0.5
Alt. F	6.4	0.9	9.9	0.0	6.4	0.5
Alt. G	6.4	0.9	9.9	0.0	6.4	0.5
Button Creek						
Alt. C, D, G	0.0	0.0	0.0	0.0	0.0	0.0
Alt. B, F	0.0	0.0	0.0	0.0	0.0	0.0
Alt. E	0.4	0.0	0.0	0.0	5.1	1.8
Bitter Lick Creek						
Alt. C, D, G	0.0	0.0	0.0	0.0	0.0	0.0
Alt. B, F	0.0	0.0	0.0	0.0	0.0	0.0
Alt. E	0.0	0.0	0.0	0.0	0.4	0.0

Table I-5. Road Density Pre- and Post-project by Subwatershed

	Pre-project miles/square mile	Post-project miles/square mile
Flat Creek		
Alt. B, C, D, G	5.70	5.2
Alt. E	5.70	5.2
Alt. F	5.70	5.4
West Branch Elk Creek		
Alt. B, C, D, G	4.62	4.1
Alt. E	4.62	3.9
Alt. F	4.62	4.5
Sugarpine Creek		
Alt. B, C, D, G	4.40	4.1
Alt. E	4.40	4.1
Alt. F	4.40	4.1
Button Creek		
Alt. B, C, D, G	5.15	5.15
Alt. E	5.15	5.15
Alt. F	5.15	5.15
Bitter Lick Creek		
Alt. B, C, D, G	3.7	3.7
Alt. E	3.7	3.7
Alt. F	3.7	3.7

Table I-6. Functioning Condition of Streams by Sections within 6th Field Watershed (in miles)

Section	Proper Functioning Condition	Functioning At-Risk with Upward Trend	Functioning At-Risk with No Apparent Trend	Functioning At-Risk with Downward Trend	Non-Functional
Elk-Flat 6th Field Watershed					
32s-1w-12	1.34	1.0	0.11	0.0	0.0
32s-1e-5	0.0	0.49	0.11	0.57	0.0
32s-1e-15	0.49	0.85	1.67	0.19	0.0
32s-1e-33	0.0	0.06	1.27	0.17	0.0
32s-1e-19	2.46	1.84	0.49	0.49	0.11
32s-1e-21	0.0	0.45	0.45	0.0	0.0
32s-1e-17	2.03	2.27	1.34	0.7	0.0
32s-1e-7	1.36	0.45	0.11	0.4	0.0
32s-1e-29	1.23	1.47	1.04	0.45	0.0
32s-1e-30	0.13	0.0	0.57	0.21	0.0
32s-1e-31	0.0	0.0	0.27	0.0	0.19
32s-1e-13	1.23	1.1	0.76	0.23	0.36
Totals	10.27	9.98	8.19	3.41	0.66
Sugarpine 6th Field Watershed					
32s-1e-3	0.83	2.73	0.38	0.0	0.0
32s-1e-4	0.25	0.0	0.0	0.09	0.0
32s-1e-8	1.14	0.8	0.28	0.0	0.0
32s-1e-15	0.25	0.0	0.0	0.09	0.0
32s-1e-5	2.16	1.33	0.3	0.0	0.0
32s-1e-9	0.38	3.09	1.8	0.0	0.0
32s-1e-7	0.68	1.17	0.08	0.11	0.06
Totals	5.69	9.12	2.84	0.29	0.06
West Branch 6th Field Watershed					
33s-1e-7	1.27	0.89	0.85	0.09	0.0
33s-1e-6	0.0	0.27	0.04	0.05	0.0
32s-1w-24	0.83	0.57	0.09	0.0	0.0
33s-1e-5	0.27	0.7	1.25	0.17	0.0
Totals	2.37	2.43	2.23	0.31	0.0

Water Quality Restoration Plan
Rogue Basin
Upper Rogue Sub-basin
Elk Creek

Bureau of Land Management (BLM), Medford District Office

2003

Elk Creek at a Glance

Hydrologic Unit Code (identification #)	1710030705
Watershed Area/Ownership	Total: 85,418 acres BLM Ownership: 27,044 acres (32 %) USFS Ownership: 23,868 acres (28%) USACE Ownership: 2,618 acres (3%) Non-federal Ownership: 31,888 acres (37%)
Stream Miles Assessed	Total: 28 miles BLM Ownership: 7 miles
303(d) Listed Parameter	Temperature, DO
Key Resources and Uses	Salmonid, aesthetic, recreation
Known Impacts (human)	Timber harvest, roads, agriculture, recreation, utility corridor, cattle grazing, partially completed dam site
Natural Factors	Geology: volcanics and intrusive volcanics Soils: various series and complexes; predominately cobbly or gravelly clay loam – moderate to slow permeability

Statement of Purpose

This water quality restoration plan (WQRP) has been prepared in partial fulfillment of the Bureau of Land Management (BLM) responsibility as a Designated Management Agency (DMA) under the 1972 Federal Clean Water Act. The WQRP further contributes to the Oregon Department of Environmental Quality (ODEQ) development of Total Maximum Daily Loads (TMDL) for the Upper Rogue Sub-Basin and is consistent with provisions of the Memorandum of Agreement (MOA) between the ODEQ and BLM (July 2003).

This plan covers land managed by the BLM and United States Forest Service within the Elk Creek Watershed from the mouth of Elk Creek at the Rogue River to the headwaters of Elk Creek.

The Oregon Department of Environmental Quality has lead responsibility for creating TMDLs and Water Quality Management Plans (WQMP) to address water quality impaired streams for Oregon. This WQRP will be provided to the ODEQ for incorporation into an overall WQMP for the Elk Creek Watershed. ODEQ has a comprehensive public involvement strategy, which includes informational sessions, mailings, and public hearings. The BLM will provide support and participate in this public outreach.

Legal Authorities to be Used

Clean Water Act Section 303(d)

Section 303(d) of the federal Clean Water Act (CWA) as amended, requires states to develop a list of rivers, streams, and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. Waters that need this additional help are referred to as “water quality limited” (WQL). Water quality limited waterbodies must be identified by the Environmental Protection Agency (EPA) or by a delegated state agency. In Oregon, this responsibility rests with the ODEQ. The ODEQ updates the list of water quality limited waters every two years. The list is referred to as the 303(d) list. The CWA section 303 further requires that TMDLs be developed for all waters on the 303(d) list. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to reduce pollution or pollutants to the load allocation level that will restore the water quality and achieve compliance with water quality standards.

Northwest Forest Plan

Federal land management is guided by the Northwest Forest Plan (NFP) that creates a system of reserves to protect a full range of species and their habitats. Biological objectives of the NFP include assurances that adequate habitat will be retained and will aid in the “recovery” of late-successional forest habitat and associated species and further prevent species from being listed under the Endangered Species Act (ESA). The Aquatic Conservation Strategy (ACS) is an essential component of the NFP, which ensures stream, lake, and riparian protection on Federal lands.

ACS Objectives

The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within USFS and BLM lands within the range of the northern spotted owl. The strategy seeks to protect salmon and steelhead habitat on lands within the range of Pacific Ocean

anadromous fish.

The ACS strives to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitat. This approach seeks to prevent further degradation and restore habitat over broad landscapes. Because it is based on natural disturbance processes, it is recognized it may take many decades to accomplish all ACS objectives. Thus, it is reasonable to consider implementation of ACS objectives according to similar timeframes as TMDL implementation.

Elk Creek

Water Quality Restoration Plan 2003

Table of Contents

Elk Creek 5th Field Watershed Analysis

Summary

MORPHOLOGY	
Geographic Province	High Cascades and Western Cascades
Watershed size	85,418 acres
Elevation range	~1450 - ~5800 feet – Mouth of Elk Creek to headwaters
Drainage pattern	asymmetrical dendritic
Total streams	1,010 miles
Drainage density	5.2 miles/mile^2
Sixth-field watersheds	West Branch Elk Creek 19,324 acres Flat Creek 5,890 acres Sugarpine Creek 17,460 acres Bitterlick 19,918 acres Button 12,832 acres Total 85,418 acres
METEOROLOGY	
Annual precipitation	Average annual precipitation ranges from less than 35 inches in the southern portion of the watershed to more than 60 inches in the northern portion.
Precipitation Timing	Mediterranean climate with wet winters and dry, hot summers.
Temperature range	0-110 degrees F seasonally
SURFACE WATER	
Minimum flow	The lowest mean daily flow of record occurred in September of 1994 when the discharge was 0.12 cfs.
Maximum peak flow	Maximum flow on Elk Creek near Trail was 19,200 cfs in Dec. 1964
Reservoirs	No large reservoirs currently within the watershed. Several small pump chances and heliponds; one constructed helipond.
Water quality limited streams	About 30 miles (listed for temperature above 64 degrees) About 11 miles listed for DO <u>Sixth-field water quality limited streams:</u> Elk Creek (5th field) West Branch Elk Creek Bitter Lick Creek
GEOLOGY	
Geologic Type	Western Cascade Volcanics and intrusive volcanic rocks.
Soils	Many different series and complexes. Moderate to slow permeability.

BIOLOGICAL			
Vegetation	Primarily mixed evergreen; conifers and hardwoods. Vegetative communities differ by slope, aspect, elevation and soils.		
Total fish streams	155 miles		
Candidate, threatened, or endangered species	Spotted owl: 18 active sites (LSR is owl core) Fish: Oregon Coast coho salmon steelhead		
Survey and Manage species	Fungi, mollusks, bryophytes, lichens and red tree vole, great grey owl		
Special Status Plants	Numerous species and locations		
HUMAN INFLUENCE			
Counties	Jackson Josephine (small portions along northern boundary)		
Roads	629 miles		
Road density	4.6 mi/ mi^2		
Streams within one tree length of roads	159 miles		
Fish streams within two tree lengths of roads	84.7 miles		
Timber production	GFMA - 0 acres		
Utility corridors	Powerline corridor		
Communities	No communities, scattered rural residential		
PUBLIC LANDS			
BLM Medford lands	27,044 acres (32%)		
	BLM Medford Land Use Allocation	**Acres**	**(Percent)**
	Late-Successional Reserves	27,044	(100)
	Recreation Sites	0	(0)
	River Corridor & Wilderness	0	(0)
	Total	27,044	
Forest Service lands	23,868 acres (28%)		
Army Corps of Engineers lands	2,618 acres (3%)		
State of Oregon lands	225 acres		

Introduction

This document is prepared to uphold the BLM's responsibilities as a DMA under the Clean Water Act. This WQRP provides a framework for describing the management necessary to protect and enhance water quality on federal lands in the Elk Creek Watershed.

This document will detail the extent that federal actions may contribute to changes in water temperature and will outline efforts to protect and enhance or restore water quality on federal lands in this watershed.

Elements of the WQRP have been coordinated with the US Forest Service that manages lands of the Elk Creek Watershed, as well as with other entities with similar land and water management responsibilities in the watershed. The WQRP includes:

1. Condition assessment and problem description
2. Resource Considerations
3. Limiting Factor Analysis
4. Goals and objectives
5. Timeline for implementation, cost, funding
6. Responsible Parties
7. Reasonable Assurance of Implementation
8. Monitoring/Evaluation Plan
9. Public Participation Plan

Element 1: Condition assessment and problem description

Table 1. Land Ownership in the Elk Creek Watershed

Ownership/Land Use	Acres	Percent of Elk Creek Watershed
Medford BLM	27,044	32
Forest Service	23,868	28
Army Corps of Engineers	2,618	3
Other non-federal lands	31,888	37
Total	85,418	100

On July 12, 2002, the Timbered Rock Fire started in the Elk Creek Watershed. This fire grew to approximately 27,000 acres before it was controlled. The fire left areas burned at severities ranging from unburned to high (see FEIS Glossary for burn severity definitions) throughout the watershed creating a mosaic typical of large wildfires. The fire burned through many streams and Riparian Reserves creating many openings along streams. These openings have reduced stream shade, in some cases, to zero percent. This natural event will delay the attainment of water quality standards. Prior to this event, water quality in the watershed varied both spatially and temporally.

Approximately 28 percent of the Elk Creek Watershed is located in the transient snow zone, making it prone to flood events that occur as a result of rain on snow events. Loss of forest vegetation resulting from events such as large fires and logging operations increases the frequency and magnitude of these

events. Much of the upper portion of this watershed consists of steep, confined channels.

Roads contribute to rapid runoff, increased groundwater interception, channel confinement at road crossings, and increased sediment delivery to streams. Most portions of the watershed have road densities greater than three miles of road per square mile, The threshold was established by the National Oceanic and Atmospheric Administration–Fisheries (NOAA-Fish) for properly functioning systems. Within these densely roaded areas, the natural system has been heavily impacted by timber harvest. New high road densities likely altered the timing and duration of localized runoff during storm events. According to current Geographic Information System (GIS) road and stream data, about 39 percent of roads within the Elk Creek are within Riparian Reserves. Of those, approximately 13.5 percent are within the Riparian Reserves of fish-bearing streams.

Elk Creek is designated in the Medford District RMP as a Tier 1 Key Watershed. Tier 1 Key Watersheds were selected for directly contributing to anadromous salmonid and resident fish species conservation (USDI 1995, 22-23).

APPLICABLE WATER QUALITY STANDARDS

Beneficial Uses

Oregon Administration Rules (OAR 340–41–322) list the designated beneficial uses for Rogue River waters, including Elk Creek. The specific beneficial uses occurring in the Elk Creek Watershed are presented in Table 2.

Table 2. Beneficial uses in the Elk Creek Watershed

Beneficial Use		Beneficial Use	
Public Domestic Water Supply	✓	Anadromous Fish Passage	✓
Private Domestic Water Supply	✓	Salmonid Fish Spawning	✓
Industrial Water Supply	✓	Salmonid Fish Rearing	✓
Irrigation	✓	Resident Fish and Aquatic Life	✓
Livestock Watering	✓	Wildlife and Hunting	✓
Boating	✓	Fishing	✓
Aesthetic Quality	✓	Water Contact Recreation	✓
Commercial Navigation and Transportation		Hydro Power	

The Oregon Environmental Quality Commission has adopted numeric and narrative water quality standards to protect these designated *beneficial use*s. In practice, water quality standards have been set at a level to protect the most sensitive beneficial use, with seasonal standards set for uses that do not occur year round. Cold-water aquatic life, such as salmon, and aesthetic quality are the most sensitive *beneficial uses* in the Elk Creek Watershed.

The Clean Water Act of 1972, as amended, provides direction for designated beneficial uses. ODEQ is responsible for developing a list of streams that fail to meet established water quality criteria for one or more beneficial uses. These designated streams are included on the State of Oregon's 303(d) list. Water quality monitoring throughout the Elk Creek Watershed has resulted in 303(d) listings for about 40 miles

of streams that fail to meet established criteria for one or more beneficial uses (see Table 3 and FEIS Map 3-8, 303(d) Listed Streams).

Table 3. Water quality limited streams in the Elk Creek Watershed 2002

Stream	Water Quality Parameter	Miles
Elk Creek	Temperature	13.3
Elk Creek	DO	11.2
West Branch Elk Creek	Temperature	7.4
Bitterlick Creek	Temperature	8.6

* Sugarpine Creek and Hawk Creek are listed as a potential concern for temperature

Streams listed for temperature do not meet the criteria (e.g., the rolling 7 day average of the daily maximum temperature) for anadromous fish rearing (e.g., temperature exceeds 64 degrees). This also applies to the resident fish and other aquatic life, particularly resident cutthroat, which are present in these streams (see FEIS Map 3-9, Fish Distribution).

The Rogue River is a major migration corridor for anadromous fish. Chinook (*Oncorhynchus tshawytscha*) and coho (*Oncorhynchus kisutch*) salmon as well as summer and winter steelhead (*Oncorhynchus mykiss)* are known to spawn in the larger creeks within this watershed during moderate to high flow periods, but are not found in the low order tributaries. Resident cutthroat trout (*Oncorhynchus clarki)* inhabit a large portion of the higher ordered streams in this watershed. Some streams within the southern portion of this watershed may have less than optimal conditions for fish habitat as a result of a partially constructed dam, timber harvest, road building, agriculture, fire suppression, and rural residential development. In most areas in the northern section of the Elk Creek Watershed, it is believed that habitat and spawning conditions are likely near their historic potential because they are mostly undisturbed. High channel gradients, lack of spawning gravel, and relatively infrequent landslides on low order side channels are natural barriers that are potentially limiting fish distribution in this watershed. The partially completed Elk Creek Dam act as a fish barrier and Oregon Department of Fish and Wildlife (ODFW) have been trapping and hauling fish around the site.

Table 4 lists historic and present condition information about elements that may affect temperature in the Elk Creek Watershed.

Table 4. Historic and current conditions of selected elements

Riparian Vegetation	
Historical Condition	• Hardwood dominated early to late seral conditions resulting from regular large scale fire events in this watershed. Though streams flowed through a mosaic of stand ages due to fire activity, riparian areas of lower ordered streams were generally well shaded by the large brush and shrub component along these narrow channels.
Present Condition	• Most riparian areas in this watershed exhibit conditions that are within the range of natural variability due to limited human influence. Some areas along Flat Creek, Middle Creek, and Alco Creek may be outside this range due to changes in peak flows resulting from previous upland timber harvest and the Timbered Rock wildfire.
Forest Health and Productivity	
Historical Condition	• Frequent, large scale fires of varying intensity maintained a mosaic of stand ages and densities.
Present Condition	• Many areas of this watershed still exhibit historical conditions. Portions of harvested areas have densely planted and overstocked (increased competition) stands. Soil compaction has altered small scale hydrologic patterns in areas where tractor harvest was used. •Timbered Rock fire burned approximately 30% of the watershed at various intensities maintaining the mosaic of stand ages and densities.
Roads	
Historic Condition	• Few roads before industrial timber harvesting began in the early 1950s.
Present Condition	• Most roads in this watershed are presently in poor to good condition. There is currently a total of about 629 miles of road with varying distribution. Maintenance on some non-arterial roads has been reduced as a result of decreased funding. These roads are in various stages of deterioration from being overgrown to in some cases having sections that have slid. Many of these deteriorating roads have been inventoried for decommission. • Road density averages 4.6 mi/mi^2
Flow Regime	
Historic Condition	• The range between high and low flows on a yearly basis can be extreme.
Present Condition	• Small changes from historic to current conditions because estimated crown closure density was slightly lower historically than currently. • Timbered Rock fire has increased water available for runoff and therefore changed flow regime by increasing peak flows until vegetation recovers.

Element 2: Resource Considerations

The Elk Creek Watershed is a fifth-field watershed in the Cascade Mountains province, located in southwest Oregon about 20 miles north of Medford, Oregon and just west of Lost Creek Reservoir (see FEIS Map 1-1, Location Map). BLM administers about 27,044 acres (32 percent) of the watershed. Within the Elk Creek Watershed, there are no major communities. There are scattered rural residences throughout this watershed.

Major tributaries of Elk Creek include West Branch Elk Creek, Flat Creek, Middle Creek, Alco Creek, Jones Creek, Sugarpine Creek, Bitterlick Creek, and Button Creek. The watershed has been divided into five sixth-field watersheds (see Table 5 and FEIS Map 3-8, 303(d) Listed Streams) and 54 seventh-field watersheds ranging from about 52 acres to about 7,596 acres. Annual precipitation in the watershed averages about 35-60+ inches, moving south to north. Extended summer drought is common.

Table 5. Sub-watersheds within the Elk Creek Watershed

Sixth-field watershed	Acres	Percent of Elk Creek Watershed	% Burned Hot and Moderate Severity
West Branch Elk Creek	19,324	23%	16%
Flat Creek	15,890	19%	39%
Sugarpine Creek	17,460	20%	16%
Bitterlick Creek	19,918	23%	0%
Button	12,832	15%	0%
Elk Creek 5th Field Total	85,418	100%	12%

The Elk Creek Watershed lies in the Western Cascades geologic province, a volcanic province. The predominant bedrock types are basalt, andesite, tuffs and sedimentary volcanic rock and intrusive volcanic rocks. The volcanic bedrock weathers into small-grained material with a tendency to erode easily.

In this watershed, soils are derived from volcanic rock types. Soils developed from volcanic rock types tend to be shallow and have less soil nutrients and soil development than sedimentary. Organic matter plays an increasing role in the productivity of the volcanic sites.

The most prevalent soils in the watershed are McNull, Medco, Straight, Shippa and Freezener, and Geppert soils and associated complexes. The parent material is andesite, tuff, and breccia bedrock. The soils are predominately cobbly or gravelly clay loam, of moderate to slow permeability. The soil classification, per Unified Soil Classification System, is silty or clayey gravels.

The southern portion of Elk Creek Watershed is like most federal lands in Western Oregon which are intermingled with non-federal lands in a alternating “checkerboard” pattern that is characteristic of much of the Oregon and California (O & C) railroad lands (see Table 1 and FEIS Map 1-1(b). Land Administration). The northern 1/3 of the watershed is typical of US Forest Service lands in that it is in block ownership.

Land Use Allocations

The Medford District Resource Management Plan (RMP) designated land use allocations for federal

lands within the watershed. These allocations provide overall management direction and varying levels of resource protection (see FEIS Map 3-1, Land Use Allocations).

Late-successional reserves (LSRs) are areas designated in the RMP where the major management objective is to protect and enhance the conditions of late-successional and old growth forest ecosystems which serve as habitat for late-successional and old growth forest related species, including the spotted owl and red tree vole. This watershed has a large percentage of land allocated as LSR by USFS and BLM and contained 18 active spotted owl sites before the Timbered Rock Fire.

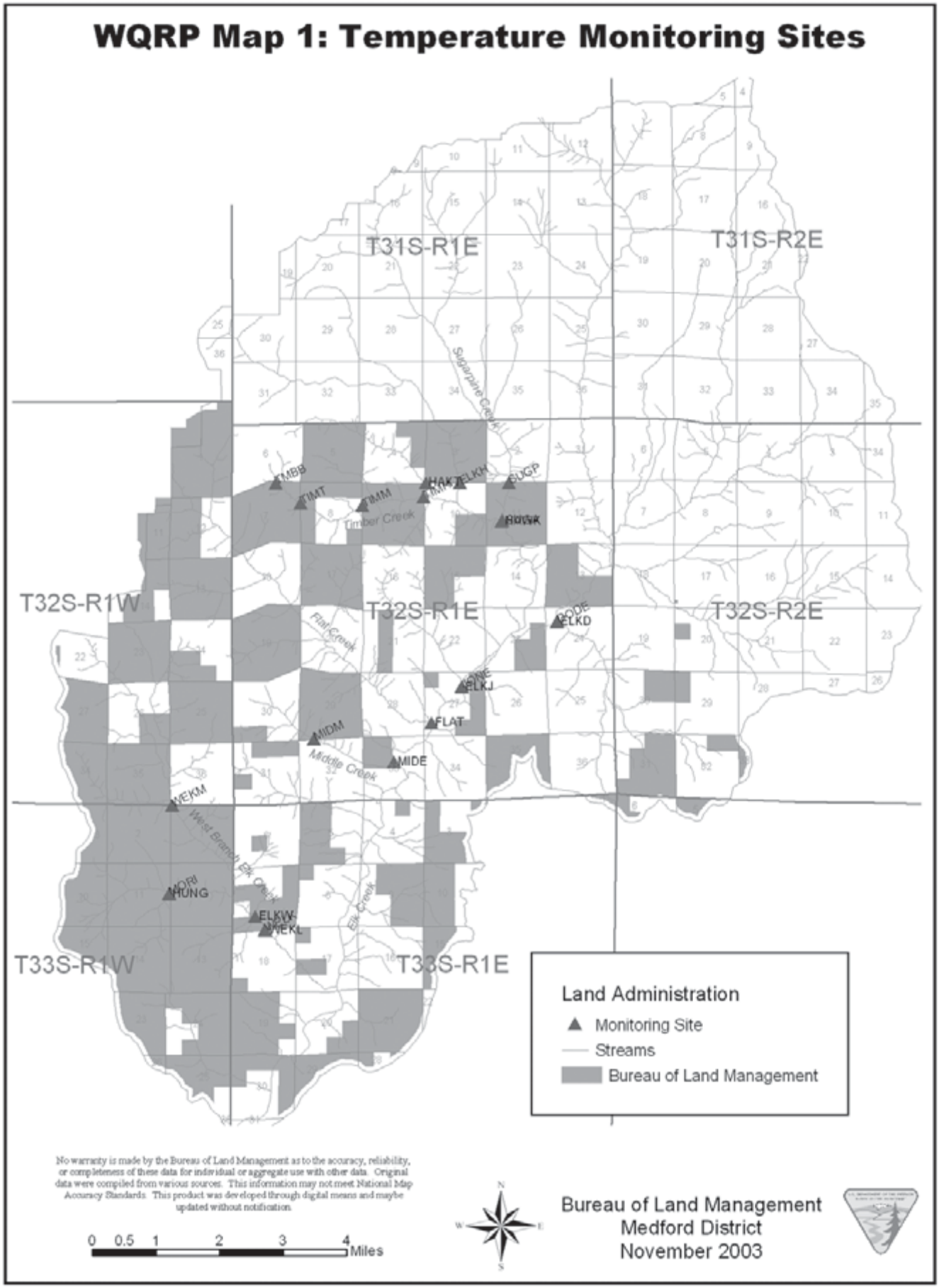
Table 6. Federal Land Use Allocations within the Elk Creek Watershed

Land Use Allocation	Acres	(Percent)
Late-Successional Reserves	50,729	(100)
Total		

Section 303(d)(1) of the Clean Water Act requires that TMDL "be established at a level necessary to implement the applicable water quality standard with seasonal variations." Both stream temperature and flow vary seasonally and from year to year in the Elk Creek Watershed. Water temperatures are cool during the winter months, and exceed the State water quality standard between June and September when stream flows are lowest and solar radiation is the highest. Table 7 lists the site locations where BLM monitoring has occurred (see Map 1). Stream temperatures in Elk Creek exceed water quality standards during some periods between June and September.

Table 7. Temperature Monitoring Locations on BLM Lands and Years Monitored

Site ID	Site Location Description	Highest 7 day temperature for period of record	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
HAWK	Hawk Creek above Sugarpine Creek	74.7					X	X	X	X	X	X
SUGA	Sugarpine Creek above Hawk Creek	72.2					X	X	X	X	X	X
WELK	West Branch Elk Creek above Morine Creek Road	66.6						X				
WEKL	West Branch Elk Creek lower section in T33S, R1E, Sec. 7	70.7										X
ELKW	West Branch Elk Creek below Morine Creek Bridge	70.4					X					
WEKM	West Branch Elk Creek below BLM section line T33S, R1W, Sec. 1	69.4										X
MORI	Morine Creek above Hungry Creek	64.1		X	X	X	X	X	X	X	X	X
HUNG	Hungry Creek @ confluence of Morine Creek	63.2		X	X	X	X	X	X	X	X	X
ELKH	Elkhorn Creek above Hawk Creek	70.6										X
HAKT	Hawk Creek above confluence with Timber Creek in Section 3	66.3										X
MIDE	Middle Creek at Elk Creek	74.7										X
MIDM	Middle Creek at south BLM boundary in Section 29	69.4										X
SUGP	Sugarpine Creek at northern property line Section 11	71.5										X
TMBB	Timber Creek Below the confluence with site BUCK	63										X
TIMT	Timber Creek at West BLM boundary of Section 8	63.6										X
TIMM	Timber Creek at west BLM boundary of Section 9	62.9										X
TIMH	Timber Creek at Hawk Creek	73.9										X


WQRP Map 1: Temperature Monitoring Sites
T31S-R1E
T31S-R2E
T32S-R1W
T32S-R1E
T32S-R2E
T33S-R1W
T33S-R1E
Sugarpine Creek
Timber Creek
Flat Creek
Middle Creek
West Branch Elk Creek
Elk Creek
MBB
TMT
TMM
HAK
ELKM
EUGP
ELKD
ELKJ
FLAT
MIDM
MIDE
WEKM
HUNG
ELKW
WEKL
Land Administration
Monitoring Site
Streams
Bureau of Land Management
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and maybe updated without notification.
0 0.5 1 2 3 4 Miles
Bureau of Land Management
Medford District
November 2003

Element 3: Limiting Factor Analysis

Analysis of water quality limited streams in the Elk Creek Watershed

Maximum summer water temperatures in the Elk Creek Watershed have probably always exceeded the current ODEQ standard because the geology and soils of this watershed do not allow for a great degree of water storage. Uplands are steep and soils are relatively shallow. Recharge of streams by ground water is very limited during summer months. In addition, bedrock, which is a major component of the substrate, absorbs heat during the day and radiates it to the stream at night. With RMP allocations and management directions, the acreage harvested in this watershed is relatively small. The BLM believes that cutting in Riparian Reserves alone is not responsible for limiting water quality in this watershed.

Private agriculture operations have removed vegetation along the mainstem of Elk Creek and near the mouths of some tributaries. The partially-constructed dam on Elk Creek has also resulted in loss of riparian vegetation along the mainstem of Elk Creek.

Thus, there are many factors that may contribute to elevated temperature in these streams. In many cases more than one factor is operating on streams and may include:

- Several tributary streams have segments that have no surface flow during summer periods;
- Low summer discharge;
- Riparian cover is absent or reduced due to land practices adjacent to streams; past salvage logging within riparian zones; logging has removed shade over streams;
- Wide streams and stream orientation allow for direct solar heating;
  "Adjacent side slope steepness, vegetation species composition, tree height, vegetation density, tree distance from the stream bank, and stream width all affect effective stream shade. Thus, although riparian vegetation provides a physical barrier between the stream and incoming solar radiation, only a portion of the riparian canopy contributes to effective stream shade" (USDA and USDI 2003, 11).
- Wide, shallow gravel/bedrock channels;
- Relatively low gradient channels result in slower velocities therefore longer water retention time; and
- High percentage of roads in or adjacent to riparian zones.

Stream channel widths on most first through fourth tributary streams are narrow enough for stream-side vegetation to provide adequate shade. Stream side vegetation in this system consists of brush, hardwood and conifer species.

Stream Flow

Flows reflect annual precipitation with higher low flows in wetter years and lower summer flows in drier years. Variation in low flow from year to year is typical for this stream system. Historic data for the gaging station is available at web site address: http://waterdata.usgs.gov/nwis/dv/?site_no=14338000 . Gaging station data is not included in this document due to volume of data on that web site.

Disturbance of the riparian area and stream channel from wildfires and floods can also contribute to increases in summer stream temperatures. These disturbances are considered part of the natural processes, and are expected change agents considered by the ACS (FEMAT 1993). Elk Creek Watershed has a frequent fire history with return intervals ranging from 15 to 100 years depending on

the stand characteristics, weather, and topography. In this watershed, it appears that fires are probably more frequent and intense in the hot, low elevation areas along Elk Creek than in the upper ridges where conditions are cooler and wetter. The eastern portion of this watershed also experiences a greater risk of fire due to the lower amounts of precipitation and higher summer temperatures. Riparian vegetation in areas disturbed by fire and flood will most likely experience fire and floods again in the future. The gain and loss of riparian vegetation by natural processes will fluctuate within the range of natural variability for this watershed and is outside the scope of this assessment. This WQRP focuses on areas where BLM management activities may exacerbate natural disturbance and result in impacts to water quality and quantity.

Factors Affecting Stream Temperature

The Elk Creek Water Quality Restoration Plan addresses stream shade, changes in channel form, and flow as the three management factors that may contribute to water temperature problems.

Temperature Factor 1. - Stream Shade

For the listed parameter, i.e., stream temperature, the beneficial uses affected are: resident fish and aquatic life and salmonid fish spawning and rearing. The state standard for Elk Creek Watershed requires that the seven (7) day moving average of the daily maximum shall not exceed 64 degrees Fahrenheit. A stream is listed as water quality limited when the rolling seven (7) day maximum average exceeds this standard.

Stream temperature is driven by the interaction of many variables. Energy exchange may involve radiation, longwave radiation, evaporative heat transfer, conduction and advection (e.g., Lee 1980, Beschta 1984). While interaction of these variables is complex, certain variables have a greater affect than others (Beschta 1987). For a stream with a given surface area and stream flow, any increase in the amount of heat entering a stream from solar radiation will have a proportional increase in stream temperature. Solar radiation is the singularly most important radiant energy source for the heating of streams during daytime conditions (Beschta 1997).

Without riparian shade trees, most incoming solar energy would be available to heat the stream. Riparian vegetation can effectively reduce the total daily solar heat load. The stream shade assessment determined where the stream shade has been reduced by management activities and calculated the resulting increase in total daily solar heat loading. To determine where shade problems exist and the magnitude of the problem, the stream network of Elk Creek was broken down into sections consisting of the main stem and its tributaries.

Management activities such as harvesting trees in the riparian area can increase the amount of solar radiation entering a stream. Similarly, increased bedload sediment that increases stream surface area can also lead to increases in solar radiation. Finally, water withdrawals during summer months (June-August) may worsen elevated temperature.

The BLM monitored several 303(d) listed streams between 1996 and 2003 (see Table 7) to determine which portions of the streams are water quality limited. Definitive information on where stream temperatures meet the standard on stream reaches has not been analyzed. It will take several years of monitoring to determine the reaches that have temperature limiting problems.

Temperature Factor 2. - Channel Form

Changes in bedload that alter channel morphology result from sediment input that exceeds transport capability of the stream. Sediment deposition can result in channel filling, thereby increasing the width-depth ratio of a stream. An increase in channel width can increase the amount of solar radiation entering a stream. A wide, shallow stream will heat up faster than a narrow, deeper stream with the same discharge. Input of sediments associated with storm events, and management related sources of sedimentation can increase sediment over natural background and contribute to channel widening and subsequent stream temperature increases.

Temperature Factor 3. - Flow

The temperature change produced by a given amount of heat is inversely proportional to the volume of water heated or, in other words, the discharge of the stream. A stream with less flow will heat up faster than a stream with more flow given that all other channel and riparian characteristics are the same. Routing of surface and subsurface waters via interception by road cuts can result in more rapid runoff during storm events and has precluded infiltration and subsequent slower release of stored water in this watershed.

Element 4: Goals and Objectives

Temperature Findings

Assessing the impact of BLM management on temperature will be based on shade and channel form. The BLM's goal is to contribute to reduction of stream temperature through shade recovery on areas of historic timber harvest. These areas are expected to take approximately 30 years after harvest to recover on the smaller tributaries (fourth order and less) on BLM lands. This conclusion is based on current age class of harvest units adjacent to streams on BLM lands taken from operations inventories (see Table 8). Riparian zones on larger tributaries and mainstem Elk Creek may take considerably longer (80 years) to recover.

Table 8. Acres of Riparian Reserve in Elk Creek by age class on Medford BLM lands.

Elk Creek		HUC 6				
Age (years)	Total	West Branch	Flat	Sugarpine	Button	Bitterlick*
Non Forest	153	114	13	20	7	n/a
0-10	529	190	266	48	24	
11-20	354	250	62	42		
21-30	226	139	39	48		
31-40	348	114	120	113		
41-50	110	23	37	50		
51-60	210	31	59	88	33	
61-70	108	9	12	29	59	
71-80	196	92	44	24	36	
81-150	1812	1205	300	190	116	
151-200	1820	759	470	574	18	
201+	2037	1306	485	160	85	
Unknown						
Total Acres:	**7,902**	**4,231**	**1,907**	**1,387**	**376**	
% over 30 years	84%	84%	80%	89%	92%	
% over 80 years	72%	77%	66%	67%	58%	
% Burned High/ Moderate	12%	15%	39%	16%	n/a	n/a

*There are no BLM-administered lands in the Bitterlick subwatershed.

An assumption was made that smaller order streams would be shaded by brush, hardwood and conifer species at an earlier age than the larger order streams. Most of the smaller order streams are hillslope constrained and narrow. When the data in Table 8 are compared to the data presented in the allocation for Federally-administered lands (see Appendix A of Appendix 1), there was found to be a strong correlation between modeled existing shade percentage and percentage of seral stages over 30 years of age. The recovery period in the TMDL is based on site potential and time required to reach maturity for conifers and disregards hardwoods and brush species.

Within the Elk Creek Watershed, sub-basins that contain streams listed on the ODEQ 303(d) list, other than the mainstem of Elk Creek, are the West Branch Elk Creek HUC 6 and the Bitterlick Creek HUC 6. Riparian Reserves in this basin have a high percentage of mature trees, and as a result are well shaded. Over 77% of trees within Riparian Reserves in West Branch are over 80 years of age, and approximately 84% are over 30 years. Most of the Bitterlick sub-basin is on USFS land and would maintain Riparian Reserves. Of the three streams on the 303(d) list in this sub-watershed, Bitterlick and West Branch Elk are both fifth order streams, and mainstem Elk Creek is a sixth order stream. West Branch Elk and Bitterlick are in narrow, steep, north-south facing canyons and therefore receive additional shade protection from abundant streamside brush and hardwoods.

OBJECTIVES

All recovery goals and plans are linked to maintaining ecosystem components currently functioning, and improving those sites that show the greatest potential for recovery. This approach will maximize recovery while minimizing expensive, extensive and risky treatments.

The objective of this plan is to eventually meet water quality standards through appropriate management practices. Anthropogenic causes of water quality degradation within this watershed will receive the majority of effort through time for restoration activities. Those standards, when met, will protect the beneficial uses identified for the Rogue Basin under the Oregon Administrative Rules (OAR) 340-41-362.

The recovery of water temperature conditions in the Elk Creek Watershed on federal lands will be dependent upon implementation of the BLM Medford District RMP and the Forest Plan for the Rogue River National Forest. Paramount to recovery is adherence to the Standard and Guidelines of the Northwest Forest Plan that contributes to ACS objectives. These include protection of riparian areas as reserves and may include some silvicultural work to reach vegetative potential as rapidly as possible.

Additional actions are identified in Step 4; Goals for Managed Lands created by ODEQ and presented on page 11 of Appendix 1. Many of these actions are not consistent with BLM's management Standards and Guidelines, or the directives of BLM. Table 9 presents the management techniques that are being implemented on BLM lands to promote the recovery of water quality limited streams, and those intended to protect those streams that are currently properly functioning.

Factors contributing to elevated stream temperatures in the Elk Creek Watershed.

- Several tributary streams have segments that have no surface flow during summer periods; Tributaries with no surface flow are typical due to the low precipitation in the summer and low groundwater storage in the watershed. Management activities can not change this factor.
- Low summer discharge; Low summer discharge is typical due to the low precipitation in the summer and low groundwater storage in the watershed. Management activities can not change this factor.
- Riparian cover is absent or reduced due to land practices adjacent to streams; past salvage logging within riparian zones; logging has removed shade over streams; Riparian Reserves are in place to protect and enhance stream temperatures during future salvage and other logging operations. Thinning or understory thinning is proposed in selected Riparian Reserves to improve tree growth and therefore improve stream shade over time, approximately 30-80 years.

- Wide streams and stream orientation allow for direct solar heating; Stream orientation cannot be changed by management activities. Stream width can be narrowed by adding structure to streams such as boulders and large wood. Boulder weirs were added to Sugarpine and Hawk creeks. Additional BLM projects to add boulder weirs, large wood, and gravel are proposed. Field observations indicate that gravels begin to accumulate after the first few storms, but it is expected to take many years to narrow the stream channels. Over time, large wood falling in streams from Riparian Reserves will also improve channel structure and therefore improve temperature.
- Wide, shallow gravel/bedrock channels; Wide, shallow bedrock channels can be improved by increasing stream structure from the addition of large wood or boulders. Boulder weirs have been added to Sugarpine and Hawk creeks to increase structure, capture gravel, and decrease channel width. Adding large wood, boulder weirs, and gravel to streams are BLM proposed restoration projects to further improve this factor. Gravels would begin to accumulate within the first year while the narrowing of the stream channel would take many years, possibly decades. Large wood will also fall into streams from the Riparian Reserves over time to improve structure.
- Relatively low gradient channels result in slower velocities therefore longer water retention time; Channel gradient cannot be changed from land management activities.
- High percentage of roads in or adjacent to riparian zones. Where possible, the BLM proposes to decommission roads in riparian zones. Approximately 11 miles of road within Riparian Reserves are proposed to be fully decommissioned. Vegetation will recover on decommissioned roads over time and would be at full shade potential after approximately 80 years, with some areas reaching potential sooner.

Table 9. Goals for Federal Lands

Element	Goal	Passive Restoration	Active Restoration
Temperature Shade Component	Achieve coolest water temperatures possible through achievement of shaded riparian reserves.	Allow vegetation to grow naturally in riparian reserves as described in the NFP Aquatic Conservation Strategy	Silvicultural projects designed to promote achievement of site potential hardwood and conifers in a more rapid manner.
Temperature Channel Form Component	Maintain channel configuration of 1st through 4th order streams on BLM lands which are currently hydrologically properly functioning at this point.	Allow natural hydrologic processes to occur within the riparian reserves. Follow standards and guidelines of NFP Aquatic Conservation Strategy	Maintain roads to reduce sediment delivery to streams. Install drainage structures capable of passing 100 year flood events. Decommission roads to minimize potential sediment sources.
Temperature Stream Flow Component	Maintain natural flow conditions. Maintain flow needed for aquatic life.	Minimize consumptive use in management of BLM lands	Work with state Watermaster to identify unauthorized diversions. Reduce road densities by decommissioning roads which are no longer needed for management.

The shade model ran by ODEQ utilized 1996 aerial photos. It is believed that some canopy closure has occurred since 1996 and therefore more shade is already on streams than is indicated in ODEQ's Water Quality Management Plan for the Rogue Basin TMDL. However, the Timbered Rock Fire has reduced shade, in some cases completely, and canopy closure will take decades to fully recover.

Element 5: Timeline for Implementation and Attainment

The goal of the Clean Water Act and associated OARs is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in many watersheds, particularly where non-point sources are the main concern.

ODEQ recognizes that TMDLs are values calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical and biological processes. Models and techniques are simplifications of complex processes, and, as such, are unlikely to produce an exact prediction of how stream surveys will respond to the application of various management measures.

WQMPs are plans designed to reduce pollutant loads to meet TMDLs. ODEQ recognizes that it may take several decades – after full implementation before management practices identified in a WQMP become fully effective in reducing and controlling pollution. In addition, ODEQ recognizes that technology for controlling nonpoint source pollution is, in many cases, in the development stages and

will likely take one or more iterations to develop effective techniques. It is possible that after application of all reasonable best management practices, some TMDLs or their associated surrogates cannot be achieved as originally established.

ODEQ also recognizes that despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated surrogates. Such events could be, but are not limited to, floods, fire, insect infestations, and drought.

The WQRP addresses how human activities will be managed. It recognized that full attainment of target load reduction at all locations may not be feasible due to physical, legal or other regulatory constraints. To the extent possible, NFP identifies potential constraints, and provides the ability to mitigate those constraints should the opportunity arise.

Where nonpoint sources are given a zero load allocation, it does not necessarily mean that human-related activities on the land are prohibited or that human activity must be removed from riparian or other areas that might impact water quality. It does mean that anthropogenic activities that might increase heat discharge to the water body must be managed to prevent, to the maximum practicable extent, further warming. Specified management will allow riparian vegetative communities to grow and propagate, and natural fluvial processes such a flood plain formation and bank stabilization to occur.

In employing an adaptive management approach BLM understands ODEQ expectations:

- the progress of the TMDLs and the WQMP on a five year basis
- evaluate the progress towards achieving the TMDLs
- Designated Management Agency (DMA) will monitor and document its progress in implementing the provisions of its WQRP implementation plan
- that DMAs will develop benchmarks for attainment which can be used to measure progress; for management agencies to revise the components of their WQRPs to address deficiencies
- to consult with DMAs on attainment of water quality standards, and revise it as appropriate.

Stream shade recovery will be realized more quickly than habitat recovery with the growth of hardwoods, e.g., alder, maple, ash and cottonwood. Habitat recovery and associated sediment storage/ routing in the channel will only recover to an optimum range of conditions with the recovery of riparian conifers to mature size. This will afford some added shade as these trees grow. Lower summer water temperatures and creation of quality habitat conditions for trout and salmon are anticipated with maturation of riparian forests in these watersheds, addressing road-related problems in the watershed, and reduced timber harvest under the NFP. Harvest related slope failure issues will be addressed through the adaptive management measures within the NFP.

The BLM proposes to accomplish reduction or maintenance of stream temperature through the following during the immediate and near future:

-Renovate and Improve roads (gravel surface, water dip, add drainage structures)
-Make emergency repairs as problems are discovered
-Maintain the BLM road network according to the State BLM Transportation Management Plan
-Utilize passive restoration such as protecting Riparian Zones so that natural recovery is realized
-Utilize active restoration such as understory and overstory thinning in Riparian Reserves.

Specific restoration proposals to accomplish the reduction or maintenance of stream temperature in the

future include:

- Replace 4 culverts for fish passage.
- Install 5 graveled rock weirs per mile.
- Install 20 instream logs per mile.
- Pre-commercial thin 225 acres of stands 10-30 years; less than 8" DBH.
- Thin 134 acres of mid-seral stands 30-80 years old; greater than 8" DBH; no commercial removal.
- Place some thinned trees into stream for fish habitat restoration.
- Plant at 10' x10' spacing with microsite emphasis (planting next to logs, stumps, etc.) in high priority riparian areas (high burn severity areas) and 50-foot strips along high burn severity fish streams.
- Partial decommission of 2.5 miles of road.
- Full decommission of 32 miles of road.
- Close 21 miles of road with a gate or guardrail barricade.
- Approximately 114 miles of seasonal road closures on secondary and non-surfaced roads.

Restoration Prioritization and Funding

Funding for instream restoration will likely be very limited for the BLM. Activity plans include decommissioning of roads, road renovation projects and possible density management projects.

Much of the restoration activity that may occur will likely be funded indirectly through projects (timber sales and silvicultural projects). Other funding sources would be utilized on a project by project basis depending on the criteria set forth in the funding source.

As part of the Clean Water Action Plan, Oregon has begun an interagency effort that identifies high priority watersheds in need of restoration and protection as part of the Unified Watershed Assessment. It is possible that funding associated with the Clean Water Action Plan could be accessed to carry out protection and restoration actions in the Elk Creek Watershed.

Element 6: Responsible Parties

Federal Lands - Participants in this plan for Federal lands include ODEQ, BLM, US Forest Service, and the US Army Corps of Engineers (USACE). The BLM and Forest Service are the major federal land managers in this watershed and are responsible for completion and implementation of the WQRP for federal lands.

Nonfederal Lands - A subsequent WQMP for the remainder of the watershed is expected to be developed by ODEQ and other state agencies responsible for lands within this watershed. That WQMP will address state and locally administered lands, including private forest lands within the Elk Creek Watershed.

The Oregon Department of Forestry (ODF) is for meeting water quality standards on nonfederal forest lands. The Oregon Board of Forestry, in consultation and with the participation and support of ODEQ, has adopted water protection rules in the form of Best Management Practices (BMP) for forest operation. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. ODF and ODEQ will jointly demonstrate how the Oregon Forest Practices Act, forest protection rules (including the rule amendment process) and BMPs are adequate protection for water

quality.

Oregon Water Resources Division (WRD) is a participant within the implementation and monitoring components of this plan. WRD will be doing flow measurements, and will also assist in identifying opportunities for converting consumptive uses to instream rights.

The Oregon Department of Geology and Mineral Industries (DOGAMI) is also a participant with respect to mining impact assessment and permit modifications. DOGAMI covers mining operations that exceed one (1) acre of disturbance or 5000 cubic yards of production within a 12- month period. Operators are required to obtain an operating permit if they are located above the 2-year floodplain of creeks and rivers.

Oregon Department of Agriculture via statute of SB 1010 which established Soil and Water Conservation Districts has jurisdiction over grazing and other farming activities. Active outreach to local farmers and ranchers will continue to occur helping to ensure water quality standards are realized.

Element 7: Reasonable Assurance of Implementation

The following table lists instream and other improvements for restoration of watershed function and water quality. BLM lands in the Elk Creek Watershed have been managed as a LSR and therefore passive restoration was the main approach to restoration in the watershed. An Emergency Stabilization and Rehabilitation Plan (ESRP) was developed as a result of the Timbered Rock fire. Many projects identified in the ESRP have recently been completed.

Table 10. Past Elk Creek Watershed Improvement Projects on BLM Lands

Elk Creek 5th Field			
Project	**Year**	**Amount Treated**	**Fish Present**
Sugarpine and Hawk Creek boulder weirs	1996	~0.25 miles	CO, ST, CT
Removed culvert and log stringer crossing on Middle Creek	2003	2 sites	CO, ST, CT
Removed culverts on tributary to Elk Creek, and on roads 32-1W-25, 32-1E-23, 32-1E-17.04	2003	3 culverts	N/A
Decommissioned roads 32-1E-29.03, 32-1E-17, and 32-1W-26.09	2003	1.2 miles	N/A
Partially decommissioned Road 32-1E-20.4	2003	1.0 mile	N/A

CH = chinook, CO = coho, ST = steelhead, CT = cutthroat N/A= Not Applicable

The following standards and guidelines from the NFP will be used to attain the goals of the Elk Creek Water Quality Restoration Plan:

<u>Stream Temperature – Shade</u>

Aquatic Conservation Strategy: B-9 to B-11, C-30 (denotes section and page # of NFP)
Standard and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30

Stream Temperature - Channel Form

Aquatic Conservation Strategy: B-9 to B-11, C-30
Standard and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30
Roads: B-19, B-31 to B-33

BLM upgraded its transportation objectives within each watershed. Part of the plan is to identify roads that need surfacing, pipe replacement or that could be decommissioned.

All the sub-watersheds have high road densities and all are above the two miles per square mile target established by NOAA-Fish. Road densities on BLM lands would be decreased where possible through road decommissioning identified in the Timbered Rock EIS.

The BLM believes restrictions within the NFP have greatly contributed to reducing impacts on the aquatic system. These include, but are not limited to, wide (160' on either side of non fish-bearing streams and 320' on either side of fish-bearing streams) riparian buffers on all streams, including intermittent channels; green-tree retention on harvest units; restrictions on new road construction and requirements for 100 year flood capacity for road crossing structures. Best management practices that were designed for implementation under the NFP also help reduce impacts and in some cases, actually restore conditions to "Properly Functioning," which is a stable stream capable of withstanding 30-year storm events.

The BLM has followed the standards and guidelines of the NFP ACS and will continue to do so. Until the NFP is revised or replaced, the BLM is responsible for implementation of the NFP.

Temperature - Shade Component

The Butte Falls Resource Area will prescribe riparian stand treatments in stands located adjacent to perennially flowing water (active restoration). This will be done on a small percentage of the watershed and will maintain a no-treatment buffer to maintain water temperatures. Pre-commercial thinning may also occur in conjunction with normal stand maintenance in units having a stream flowing through or adjacent to them. BLM will continue to adhere to the ACS of the NFP by providing riparian reserves along streams.

Temperature - Channel Form Component

Through management activities such as timber sales, Title II county restoration funding and routine maintenance, BLM will endeavor to reduce road generated sediment. Monitoring of actions will take place periodically to ensure desired reduction of sediment is achieved.

Temperature – Flow

Passive management will be stressed as there are no current identified opportunities for flow augmentation within the federal managed lands of this basin.

Element 8: Monitoring/Evaluation Plan

Assessing Potential for Recovery - Properly Functioning Condition Methodology

Recovery of riparian areas, stream channels, and aquatic habitat requires a base condition with adequate vegetation, channel form, and large woody debris to dissipate stream energy associated with high water flows. The BLM/USFS methodology known as Properly Functioning Condition (PFC) assesses the capability of streams to withstand 30-year interval storm events. The BLM/USFS methodology is different than the NOAA-Fish PFC methodology in that it is an assessment of stream channel condition rather than watershed condition. This quick, interdisciplinary method is the first step in determining the feasibility of restoration and recovery (Riparian Area Management TR 1737-15 1998).

BLM will continue to monitor stream temperatures at selected sites in cooperation with ODEQ and the U.S Geological Survey.

Since streams in this watershed are water quality limited as a result of high temperatures, sediment monitoring in the Elk Creek Watershed is limited to effectiveness monitoring of actions associated with road use, construction, decommissioning, or maintenance. In addition to regular effectiveness monitoring, all activities on BLM lands adhere to the Medford RMP BMPs as well as the ACS of the NFP.

Assessing Potential for recovery – ODFW Methodology

Restoration in the Elk Creek Watershed will be both active and passive. Growth of vegetation on floodplains is integral to recovery. The overall goal is to move the attributes considered in this assessment; pool/riffle ratio, pool frequency, large wood, and riparian forest conditions from the present "poor" and "fair" ratings to "good" and "fair," per ODFW benchmarks. These attributes are used to measure if and when the stream is nearing its biological potential for supporting dependent aquatic and riparian species, including anadromous fish. Natural variation will cause changes in stream and floodplain conditions and make allowance for some attributes as being rated "fair". These attributes and benchmarks should be validated with subsequent inventory and monitoring work in the watershed, refining them to suit the range of conditions expected in the watershed as we learn more.

Monitoring will provide information as to whether standards and guidelines are being followed, and if actions prescribed in the WQRP are achieving the desired results. In addition to the monitoring identified in the WQRP, RMP/Forest Plan monitoring occurs annually to assess implementation of standards and guidelines. Information obtained from both sources of monitoring will ascertain whether management actions need to be changed. Continued monitoring would be prioritized upon review of findings.

The monitoring plan itself will not remain static and will be periodically adjusted, as appropriate; to assure the monitoring remains relevant (see Table 11).

Temperature

The BLM, with cooperators, will continue to monitor stream temperatures in portions of the Elk Creek Watershed. We monitor to meet a variety of objectives, so site locations will vary over time. Monitoring activities for BLM will try to determine the source area of temperature increase within reaches of streams that are listed for temperature. Through monitoring, BLM's goal is to determine the upper extent of the problem area and delist the reaches or streams that through time meet the water quality standard

for temperature. Our objectives are to monitor long-term temperature recovery, better understand the natural temperature variability, and to track potential project effects. There are several locations that are monitored annually during the summer months to establish temperature ranges within the basin.

Table 11. Interim Benchmarks and monitoring strategy for Elk Creek

Element	Management Measure	Interim Benchmark	Monitoring Parameter	Monitoring Frequency
Temperature Shade component	Passive treatment of riparian vegetation. Implement standards and guides of NFP. Some PCT and thinning may occur in conjunction with units that have streams flowing through or adjacent to them.	Allow stands to grow toward shade target.	Shade, canopy closure over stream focusing first on hardwood species.	Review of selected reaches every 5 to 10 years using aerial photos, field check condition of riparian vegetation. Within one year complete PFC surveys for selected streams within basin.
Temperature Channel form component	Maintain integrity of streams channels on land under BLM control.	Assess roads and culvert conditions within the watershed within the next 2 years.	Sedimentation resulting from roads by miles of road surfaced or decommissioned.	Review yearly miles of road decommissioned, renovated or maintained.
Temperature Flow component	Road management objectives	Yearly evaluation	Proper drainage and routing	Miles of road decommissioned, out sloped, rocked, number of culverts replaced.

Element 9: Public Participation Plan

This WQRP is a procedural step that focuses on water quality using elements of the NFP. Watershed analyses are a recommended component of the ACS under the NFP and RMP. The Record of Decision (ROD) for the RMP was signed in June of 1995, following extensive public review.

Public involvement was integrated into the development of both the Elk Creek Watershed Analysis, as well as the Timbered Rock EIS (August, 03). Public meetings were held in Butte Falls and Shady Cove during that process. Public involvement for the WQRP will be coordinated by ODEQ in conjunction with the effort addressing state, county and private lands within this watershed.

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Appendix 1- Rogue Basin Riparian Condition Assessment

Rogue Basin Riparian Condition Assessment

BLM and Private Managed Lands

Oregon Department of Environmental Quality
Medford Offices

Hydro Dynamics
P.O. Box 633
Grants Pass, OR 97528

2003

Table of Contents

List of Tables

Legend of Terms, Abbreviations, and Acronyms

General

BLM – Bureau of Land Management
BTU – British Thermal Unit
cfs – cubic feet per second
DEQ – Department of Environmental Quality
FPA – Forest Practices Act
ODFW – Oregon Department of Fish and Wiildlife
OAR – Oregon Administrative Rule
ODF – Oregon Department of Forestry
TMDL – Total Maximum Daily Load
Qa – average annual discharge (stream flow)
USFS – United States Forest Service
USGS – United States Geologic Service
HUC – Hydrologic Unit Code

Assessed Parameters

Definitions/Descriptions of Spreadsheet Parameters

Reach Ident – numeric code: unique identifier for each reach. Reaches are numbered from the headwaters to the mouth.
Stream Name – name of primary stream or location of named tributary confluence.
HUC 5 – Fifth field Hydrologic Unit Code
HUC 6 – Sixth field Hydrologic Unit Code
Stream Name – name of primary stream or location of named tributary confluence.
Percent Tree Overhang – percent vegetative cover on stream surface when the sun is directly overhead of the stream.
Flow Width - Low flow wetted width.
Active Channel Width – As measured from confining bank to confining bank. This is termed Active Channel Width, which in most cases it is equal to bankfull channel width.
Reach Length – linear stream distance for each reach.
Average Tree Height – average height of the shade producing trees or vegetation.
Side Slope – terrain slope under the riparian shade vegetation.
Stream Orientation – Stream direction from north (range +90 to –90).
Active Channel-Riparian Distance – linear distance from the active channel edge to base of riparian vegetation.
Shade Density – percent shade quality with current vegetative conditions.
Banks – Parameters estimated include both banks or east and west banks separately.
Seral Stage – Early = 0 to 39 years, Mid = 40 to 99 years, Late = 100 plus.
Percent Species Composition – Percent composition of hardwoods and conifiers that comprise the total population of the riparian vegetation.
Land Use – F – Forest
M - Mixed
Ag – private agriculture

U– urban

Ownership – Pvt – Private

BLM – Bureau of Land Management

Unstable Stream Banks – Location of unstable stream banks affecting survival of riparian vegetation.

Rosgen Channel Type – stream channel classification based on channel slope, sinuosity, valley type, and stream pattern and form.

Gradient – Slope of the stream channel.

Channel Confinement – As defined by Rosgen: Entrenched (<1.4); Moderately Entrenched ((1.4 – 2.2); Slightly Entrenched (>2.2).

Channel Sinuosity – As defined by Rosgen: Low (<1.2); Moderate (>1.2); High (>1.4).

Stream Order – Stream order is assigned from the top of the drainage down starting with first order (1). At the confluence of two first orders the stream progresses to a second order (2) and so forth. Stream order is based on BLM's GIS stream layer, drainage area and map contours.

ODF Stream Class – 1998 ODF FPA definitions:

F = fish bearing

N = non-fish

D = no fish domestic water source.

Percent Existing Shade - Percent existing stream shade estimated by the SHADOW stream shade model.

Percent Potential Shade – Percent potential stream shade assuming site potential vegetation or that vegetation that produces 80% stream shade, which for small streams may be less than site potential as estimated using the Shadow stream shade model.

Year to Achieve Potential Shade – years to site potential tree height estimated from forest growth models using current tree heights.

Secondary Riparian Width – Distance from the edge of the active channel to the farthest tree that provide shade during low solar radiation hours from 6:00 AM to 10:00 AM and from 2:00 PM to 6:00 PM.

Primary Riparian Width – Distance from the edge of the active channel to the farthest tree that provide shade during high solar radiation hours from 10:00 AM to 2:00 PM.

Data Source – Identifies if aerial photographs or digital orthoquads were used as a data source.

Remarks – Assessment remarks regarding reach conditions.

Step 1

Two methods were used to collect information on the stream reaches. Protocol A supplies the highest resolution information. Protocol B allows for a more rapid assessment but there is some loss in resolution. Comparison of estimated information using this method with field measurements and aerial photographs showed some loss in accuracy in identifying riparian species composition, sediment sources and vegetative height. Table 1 lists the streams and method used and Table 2 the information collected from the photographs and maps.

Table 1. Protocol					
	HUC 5	**HUC 6**	**Measured BLM (miles)**	**Measured Private (miles)**	**Protocol**
Rogue River	1710031008 1710031006 1710031005 1710031004 1710031001 1710030804 1710030802 1710030707		30	91	A
Middle and Lower Rogue					
Foot		171003080206	0	3.7	B
Kane		171003080204	0.6	4.9	B
Sams		171003080203	1.3	6.2	B
Sardine		171003080205	0	3.4	B
Galls		171003080204	0	5.2	B
Bee		171003080401	1.1	0.5	B
Birdseye		171003080207	0.2	3.9	B
Savage		171003080401	0.6	4.5	B
Whiskey		171003100401	2.4	0	B
Louse		171003100203	2.2	10.9	B
Quartz		171003100204	0.7	6.8	B
Jump Off Joe		171003100201 171003100202 171003100204	4.3	20.2	B
Galice		171003100104	1.4	0.4	B
SF Galice		171003100104	0.4	0	B
Mule		171003100407	14	0	B
Dutcher		171003100101	0.08	2.6	B
Hog		171003100102	2.3	2.4	B
Pickett		171003100101	3	2	B
Shan		171003100101	0.6	1.3	B
Taylor		171003100103	0.5	2.1	B
Foster		171003100602	0	0.6	B
Total			**35.68**	**81.6**	
Evans Creek Watershed					
Evans below W.F		171003080306		19.3	
Evans above W.F		171003080301	3.2	12.7	A
WF Evans		171003080306 171003080303	7	8	A
Battle		171003080303	2.5	1.4	B
Cold		171003080303	1.5	2.8	B
Pleasant		171003080305	2.3	11.1	B
Ramsey		171003080304	1.5	1.9	B
Rock		171003080303	3.7	4.1	B
Salt		171003080303	2	4.4	B

Table 1. Protocol

	HUC 5	HUC 6	Measured BLM (miles)	Measured Private (miles)	Protocol
RF Salt		171003080303	2.6	0	B
Total			**26.3**	**65.7**	**B**
Upper Rogue					
Elk		171003070501 171003070502 171003070504 171003070505	0.3	14	A
SF Little Butte		171003070803 171003070805 171003070806	1.6	8.6	A
NF Little Butte		171003070801 171003070802	1	6.6	A
Little Butte		171003070807 171003070808 171003070809 171003070810	0	16.1	A
Jackass		171003070405	2.3	2.4	B
Dog		171003070406	0.8	3.9	B
NF Big Butte		171003070405	6	6.9	B
Big Butte		171003070406 171003070408	2.1	10.1	B
Clark		171003070408	2.1	3.1	B
Twincheria		171003070401	1.7	3	B
Willow		171003070403	0	4.5	B
Hawk		171003070504	0.2	0.7	B
WB Elk		171003070505	5.4	2.6	B
Bitterlick		171003070501	0	1.6	B
Sugarpine		171003070503	0.8	2.4	B
Deer		171003070806	2.2	0.7	A
soda		171003070806	4.9	0.3	A
Lost		171003070806	4.6	4.1	A
Lake		171003070805	1	3.7	A
WF Dead Indian		171003070805	1	1.5	B
Dead Indian		171003070805	0.4	6.4	B
Conde		171003070805	1.2	3.9	B
Antelope		171003070811 171003070812	1.2	21.3	B
Burnt Canyon		171003070811	2	1.8	B
Trail and EF WF		171003070601 171003070602 171003070603	5.3	14.4	B
Total			**48.1**	**144.6**	

Step 2

Protocol A – Stereoscopic aerial photo interpretation and mapping was performed using BLM supplied 1996 color air photos at 1:12,000 scale.

Protocol B – Ortho-photo quads (7.5 min) interpretation and mapping was performed using BLM supplied 1994 quads.

In addition to aerial photos and ortho-quads, reach information was gathered using 7½' USGS quadrangle maps, and ODF stream classification maps

Reach breaks were established using the following criteria: 1) ownership boundaries BLM GIS Map; 2) significant changes in terrain slope; 3) change in aspect class;4) change in riparian vegetation; 5) change in stream width. Each reach was given a unique numeric identification. Reaches were numbered sequentially from headwaters to the mouth.

The riparian assessment consisted of interpretation or measurement of shade parameters, riparian vegetation, and channel conditions. These values were taken either from the color aerial photos, photo ortho-quads or USGS quadrangle map (Table 2). Table 3 lists the miles assessed and listed 303(d) parameter(s).

Modeling results for existing and potential shade values, years to shade recovery and general disturbance types observed are reported in Watershed Summary Table (Appendix A).

Table 2. Photo and map assessed attributes.

Assessment Parameter	Comments
Shade	
Percent Overhang	Photo Estimated
Percent Shade Density	Photo Estimated
Terrain Slope	Map
Aspect	Map
Tree-to-Channel Distance	Photo Estimated
Tree Height	Photo Estimated
Width – Active Channel	Photo measure if possible
Reach Length	Computer program Terrain Navigator
Overhang	Photo Estimated
Vegetation	Photo Estimated
Buffer Width	Fed. = 300' max; Non-fed. = 100' max
Percent of Reach	Non-federal land only
Veg. / Composition mix	Photo Estimated
Channel	
Stream Order (Strahler)	USGS 7½' quadrangles
Stream Slope	Map
Rosgen Channel – Level 1	Photo Estimated
Bank Stability	Photo Estimated
Comments	Photo
Others	
ODF Stream Class	ODF map
Land Use	Photo

Step 3

Table 3. 303(d) Streams assessed and listed 303(d) parameter

Waterbody Name	Stream Segment	Listed Parameter	Miles Assessed
Rogue River	Mouth to RM 132 RM 68.3 to RM110.7 RM 0 to RM94.9	Temperature Fecal Coliform pH	121 0 0
Middle and Lower Rogue			
Foot	Mouth to headwater	Temperature	3.7
Kane	Mouth to headwater	Temperature	5.5
Sams	Mouth to headwater	Temperature	7.5
Sardine	Mouth to headwater	Temperature	3.4
Galls	Mouth to headwater	Temperature	5.2
Bee	Mouth to headwater	Temperature	1.6
Birdeye	Mouth to headwater	Temperature	4.1
Savage	Mouth to headwater	Temperature	5.1
Whiskey	Mouth to headwater	Temperature	2.4
Louse	Mouth to headwater	Temperature	13.1
Quartz	Mouth to headwater	Temperature	7.5
Jump Off Joe	Mouth to headwater	Temperature	24.5
Galice	Mouth to headwater	Temperature	1.8
SF Galice	Mouth to headwater	Temperature	0.4
Mule	Mouth to headwater	Temperature	14
Dutcher	Mouth to headwater	Temperature	2.7
Hog	Mouth to headwater	Temperature	4.7
Pickett	Mouth to headwater	Temperature	5
Shan	Mouth to headwater	Temperature	1.9
Taylor	Mouth to headwater	Temperature	2.6
Foster	Mouth to headwater	Temperature	0.6
Evans Creek Watershed			
Evans	Mouth to headwater	Temperature	35.2
WF Evans	Mouth to headwater	Temperature	15
Battle	Mouth to headwater	Temperature	3.9
Cold	Mouth to headwater	Temperature	4.3
Pleasant	Mouth to headwater	Temperature	13.4
Ramsey	Mouth to headwater	Temperature	3.4
Rock	Mouth to headwater	Temperature	7.8
Salt	Mouth to headwater	Temperature	6.4
RF Salt	Mouth to headwater	Temperature	2.6
Upper Rogue			
Elk	Mouth to headwater	Temperature DO	14.3 0
SF Little Butte	Mouth to headwater	Temperature	10.2
NF Little Butte	Mouth to headwater	Temperature	7.6
Little Butte	Mouth to headwater	Temperature Fecal Coliform DO Sedimentation	16.1 0 0 0

Table 3. 303(d) Streams assessed and listed 303(d) parameter

Waterbody Name	Stream Segment	Listed Parameter	Miles Assessed
Jackass	Mouth to headwater	Temperature	4.7
Dog	Mouth to headwater	Temperature	4.7
NF Big Butte	Mouth to headwater	Temperature	12.9
Big Butte	Mouth to headwater	Temperature DO	12.2 0
Clark	Mouth to headwater	Temperature	5.2
Twincheria	Mouth to headwater	Temperature	2
Willow	Mouth to headwater	Temperature	4.5
Hawk	Mouth to headwater	Temperature	0.9
WB Elk	Mouth to headwater	Temperature	8
Bitterlick	Mouth to headwater	Temperature	1.6
Sugarpine	Mouth to headwater	Temperature	3.2
Deer	Mouth to headwater	Temperature Sediment	2.9 0
Soda	Mouth to headwater	Temperature Sediment	5.2 0
Lost	Mouth to headwater	Temperature Sediment	8.7 0
Lake	Mouth to headwater	Temperature Sediment	4.7 0
WF Dead Indian	Mouth to headwater	Temperature	2.5
Dead Indian	Mouth to headwater	Temperature	6.8
Conde	Mouth to headwater	Temperature	5.1
Antelope	Mouth to headwater	Temperature	22.5
Burnt Canyon	Mouth to headwater	Temperature	3.8
Trail &EF WF	Mouth to headwater	Temperature	19.7

Beneficial Uses in the Rogue Basin

Beneficial Use	*Occurring*	*Beneficial Use*	*Occurring*
Public Domestic Water Supply	√	Anadromous Fish Passage	√
Private Domestic Water Supply	√	Salmonid Fish Spawning	√
Industrial Water Supply	√	Salmonid Fish Rearing	√
Irrigation	√	Resident Fish and Aquatic Life	√
Livestock Watering	√	Wildlife and Hunting	√
Boating	√	Fishing	√
Aesthetic Quality	√	Water Contact Recreation	√
Commercial Navigation & Trans.	√	Hydro Power	√

Water Quality Standards & Criteria of Concern

The water quality standard of concern is temperature and flow modification. The temperature standard for the Rogue Basin tributary streams is defined in OAR 340-41-362, "The rolling seven (7) day average of the daily maximum shall not exceed… 64 deg. F (17.8 deg. C)". The standard for flow modification is defined in OAR 340-41-027, " **The creation of** tastes or odors or toxic or other **conditions that are deleterious to fish or other aquatic life** or affect the potability of drinking water or the palatability of fish or shellfish shall not be allowed. This assessment deals specifically with temperature as affected by riparian vegetation and channel conditions and does not address specific flow related issues.

The beneficial uses affected by high summer stream temperatures and/or low flow regimes on these streams are Resident Fish & Aquatic Life and Salmonid Fish Spawning and Rearing.

Pollution Sources

Disturbances to the stream channel and riparian vegetation include timber harvests, agricultural activity (non-cultivated), local and forest access roads, state or county highways, rural residential, and water withdrawals. Disturbances that are relevant to federally managed lands are timber harvests and roads. Impacts are noted if they occur with in 300 ft of the stream on federal lands or 100 ft on non-federal lands. Although disturbances may be present, their overall impact on riparian shade can be variable.

Step 4. Goals for Managed Lands

Element	Goal	Passive Restoration	Active Restoration
Temperature *Shade Component*	• Achieve coolest water possible through achievement of potential shade values.	• Allow riparian vegetation to grow up to reach target values.	• Bank stabilization where indicated. • Prescriptions that increases growth rate and survival of riparian vegetation. • Prescriptions to ensure long-term vegetation health. • Planting to increase density or to increase tree height.
Temperature *Channel Form Component*	• Maintain or improve Rosgen channel types that exist – types A, B, and C, focusing on width-to-depth ratios. • Decrease bedload contribution to channels during large storm events. • Increase wood-to-sediment ratio during mass failures.	• Allow historic failures to revegetate. • Follow Standards and Guidelines in the NW Forest Plan for Riparian Reserves, and unstable lands. • *Allow natural channel evolution to continue. Time required varies with channel type.*	• Treat roads, esp. sites with diversion potentials. • Minimize future failures through stability review and land reallocation if necessary. • Maintain and improve road surfacing. • Increase pipes to 100-yr flow size and/or provide for overtopping during floods. • *Insure that unstable sites retain large wood to increase wood-to-sediment ratio.*
Temperature *Stream Flow Components:* *- Withdrawals* *- Hydrograph*	• Maintain optimum flows for fish life. • Maintain minimum flows for fish passage.		• Work with state Watermaster to identify and stop illegal diversions. • Eliminate clear-cut logging practices. • Educate water users on effective use and conservation. • Reduce road densities by decommissioning non-essential roads. • *Improve efficiency of withdrawal systems (ditch to pipe).* • *(Purchase/lease floodplain easements.)* • *(Purchase/lease water rights with a focus on high consumptive use and old priority date.)* • *(Enforce existing regulations, including monitoring.)*

Shade Model Assumptions

Shade is based on the earth-sun-terrain/vegetation relationship on August 1 for specified latitudes. The shade model Shadow was used to calculate percent shade.

Existing shade is simply a measure of the amount of shade provided by the existing vegetation to the stream. This may or may not be the “total potential shade” or the most shade possible given the channel characteristics (stream width) and sites ability to grow trees. Existing shade is a measure of the current condition. Site potential shade is the optimum shade that can be expected given the channel and site characteristics.

In theory, it is possible to reach 100% stream shade. However, small amounts of sunlight will penetrate the most densely stocked trees. So in reality, the upper limit of potential stream shade is not 100% but between 95 to 97%. As a stream gets wider, at some point even the tallest of mature trees can’t shade the entire channel width.

Site potential shade is the optimum shade expected at a site given its specific characteristic such as stream width and riparian area productivity to grow trees. For this assessment, site potential shade was only projected where human activities have altered riparian vegetation. It does not include areas where poor site conditions restrict vegetation growth, such as serpentine sites, or natural disturbance.

Stream width is an important consideration in determining the height of the trees needed to produce site potential shade. In the assessment, conifers 120 feet in height and with a stand stocking sufficient to produce a shade density of 65% was used for channels greater than 20 feet in width. In the many small tributaries with stream widths less than 20 feet, hardwoods are considered sufficient to produce site potential shade. For these small streams, site potential shade is considered greater than 80%.

Forest growth models were used to project growth rates and heights for the dominant riparian tree species. Growth models are constructed by species and delineated by site index (SI) values that relate to growing conditions. Tree species in Rogue basin and associated SI values are listed in Table 4.

Riparian corridors are assumed to be manage to reach their full site potential condition. Shade densities for site potential conditions were set at 65% for a conifer dominant, mixed old growth stand and 70% for a mature hardwood dominant stand. Stand densities and recovery times (e.g. years to grow to site potential heights) assumes the existing vegetation will continue to grow through seral progressions to a late seral stage. Natural events such as floods or fires may alter the progression rate and achievement of late seral stand conditions.

Passive restoration and the projected time of recovery assume that the vegetation for recovery is present and trees just need time to grow. The aerial photographs used in the assessment are 1996 and the ortho-quads 1994. Recovery time remaining is determined by subtracting the year of the photograph from the current year and then the estimated recovery time. If the data table estimates recovery times of 7 or 9 years, depending on the information source, these sites are most likely recovered.

Active restoration assumes that the time of recovery begins when the identified restoration active occurs. For example, if the active restoration activity identifies planting to increase density with a recovery time of 40 years and that activity doesn't occur for 10 years, then the time of recovery from the present is 50 years.

Table 4. Tree species and forest growth model SI values.

Tree Species	Site Index	Height	Years
Alder	80	100	80
Douglas fir	85	120	80
Ponderosa pine	85	120	75

Appendix A

Weighted stream shade and recovery time

Rogue Assessment										
	BLM				Private				BLM and Private	
	Stream Miles	% Shade		Years to Recovery	Stream Miles	% Shade		Years to Recovery	% Shade	
		Existing	Potential			Existing	Potentia		Existing	Potential
Rogue River	30	2	18		91	8	26		6	20
Middle and Lower Rogue										
Foot	0				3.7	81	82	25		
Kane	0.6	93	93		4.9	86	86		87	87
Sams	1.3	88	88		6.2	84	89	15	85	88
Sardine	0				3.4	76	85	45		
Galls	0				5.2	89	89			
Bee	1.1	99	99		0.5	91	91		96	96
Birdseye	0.2	95	95		3.9	88	90	5	92	93
Savage	0.6	97	97		4.5	75	80	15	88	90
Whiskey	2.4	83	83		0					
Louse	2.2	90	90		10.9	76	80	30	79	84
Quartz	0.7	95	95		6.8	89	89		90	90
Jump Off Joe	4.3	80	82	45	20.2	64	74	80	67	75
Galice	1.4	80	83	70	0.4	63	80	70	76	82
SF Galice	0.4	92	92		0					
Mule	14	90	91	5	0					
Dutcher	0.08	94	94		2.6	79	85	28	80	85
Hog	2.3	91	91		2.4	86	88	8	86	89
Pickett	3	87	88	10	2	74	82	23	81	86
Shan	0.6	92	92		1.3	81	83	10	85	86
Taylor	0.5	88	88		2.1	80	82	35	81	83
Foster	0				0.6	82	82			
Evans Creek										
Evans below W.F					19.3	29	54	80		
Evans above W.F	3.2	88	90	15	12.7	85	88	35	85	88
WF Evans	7	75	81	55	8	63	78	55	69	79
Battle	2.5	94	94		1.4	90	90		93	93
Cold	1.5	84	85	8	2.8	67	81	25	73	83
Pleasant	2.3				11.1					
Ramsey	1.5	84	90	5	1.9	85	91	8	84	90
Rock	3.7	90	90		4.1	84	86	55	87	87
Salt	2	92	92		4.4	82	84	5	85	86
RF Salt	2.6	93	93		0					

Rogue Assessment										
	BLM				Private				BLM and Private.	
	Stream Miles	% Shade		Years to Recovery	Stream Miles	% Shade		Years to Recovery	% Shade	
		Existing	Potential			Existing	Potential		Existing	Potential
Upper Rogue										
Elk	0.3	55	80	50	14	47	74	80	48	74
SF Little Butte	1.6	62	74	40	8.6	33	70	80	38	71
NF Little Butte	1	95	95		6.6	79	83	80	81	85
Little Butte	0				16.1	31	61	80		
Jackass	2.3	89	89		2.4	82	99	12	84	96
Dog	0.8	88	88		3.9	64	80	15	68	82
NF Big Butte	6	72	83	45	6.9	65	82	45	68	83
Big Butte	2.1	52	80	80	10.1	49	80	80	49	80
Clark	2.1	93	93		3.1	84	88	25	88	90
Twincheria	1.7	90	90		3	73	87	35	79	88
Willow	0				4.5	80	84	15		
Hawk	0.2	87	87		0.7	77	80	10	82	85
WB Elk	5.4	85	85		2.6	86	86		86	86
Bitterlick	0				1.6	89	89			
Sugarpine	0.8				2.4	72	76	80		
Deer	2.2	95	95		0.7	99	99		96	96
Soda	4.9	78	89	30	0.3	90	90		79	89
Lost	4.6	92	92		4.1	71	83	40	82	88
Lake	1	97	97		3.7	75	81	25	79	84
WF Dead Indian	1	33	33		1.5	6	6		17	17
Dead Indian	0.4	87	87		6.4	48	53	63	50	55
Conde	1.2	88	88		3.9	20	20		28	28
Antelope	1.2	81	87	55	21.3	71	84	80	75	86
Burnt Canyon	2	95	95		1.8	78	84	10	87	90
Trail	4.1	84	92	65	6.5	52	81	65	65	85
WF Trail	1.2	90	90		7.9	82	83	35	86	88